

## Claims

- [c1] 1. A catalyst system for use in reducing emissions from an exhaust gas stream comprising:
- a first catalyst for optimizing the storage of NO<sub>x</sub> emissions under lean air/fuel ratios, comprising a Perovskite-type ABO<sub>3</sub> crystal structure wherein the A cation sites are occupied by lanthanide ions and the B cation sites are occupied by cobalt ions, wherein from about 1 to up to 70% of the lanthanide A cation sites are substituted with a NO<sub>x</sub> trapping metal selected from the group consisting of barium, magnesium, and potassium, wherein from about 1 to up to 60% of the cobalt B cation sites are substituted with a metal selected from the group consisting of platinum, rhodium, iron, copper and manganese; and
- a second catalyst for optimizing the reduction of hydrocarbon, NO<sub>x</sub> and CO emissions under stoichiometric air/fuel ratios, comprising a catalyst mixture PM-Rh where PM is a catalyst material selected from the group consisting of platinum, palladium and combinations thereof.
- [c2] 2. The catalyst system of claim 1, wherein the first catalyst is prepared by sol-gel.
- [c3] 3. The catalyst system of claim 1, wherein the first catalyst is prepared by co-precipitation.
- [c4] 4. The catalyst system of claim 1, wherein the ratio of PM to Rh is between 9 and 1.
- [c5] 5. The catalyst system of claim 1, wherein the ratio of PM to Rh is between 7 and 1.
- [c6] 6. The catalyst system of claim 1, wherein the PM has a total loading of 20–60 g/ft<sup>3</sup>.
- [c7] 7. The catalyst system of claim 1, wherein the PM has a total loading of 40–60 g/ft<sup>3</sup>.
- [c8] 8. The catalyst system of claim 1, wherein the first catalyst has the formula La<sub>0.5</sub>Ba<sub>0.5</sub>Co<sub>0.9</sub>Rh<sub>0.1</sub>O<sub>3</sub>.

- [c9] 9. The catalyst system of claim 1, wherein the first catalyst has the formula  $\text{La}_{0.5} \text{Ba}_{0.5} \text{Co}_{0.6} \text{Fe}_{0.3} \text{Pt}_{0.1} \text{O}_3$ .
- [c10] 10. The catalyst system of claim 1, wherein the first catalyst has the formula  $\text{La}_{0.5} \text{Ba}_{0.5} \text{Co}_{0.9} \text{Pt}_{0.1} \text{O}_3$ .
- [c11] 11. The catalyst system of claim 1, wherein the catalyst mixture PM-Rh is coated on an alumina substrate.
- [c12] 12. The catalyst system of claim 11, wherein the alumina substrate in the second catalyst is stabilized by 2–20%(wt) BaO.
- [c13] 13. The catalyst system of claim 11, wherein the PM is loaded on the alumina substrate by wet impregnation.
- [c14] 14. The catalyst system of claim 1, wherein the platinum and rhodium in the second catalyst are placed on Ce and Zr particles of 2–20%(wt).
- [c15] 15. The catalyst system of claim 1, wherein an exhaust gas sensor is placed between the first and second catalysts.
- [c16] 16. The catalyst system of claim 1, wherein the first and second catalysts are closely coupled, the first catalyst being placed in a forward position and the second catalyst being placed in a downstream position.
- [c17] 17. A method of reducing emissions from an exhaust gas stream comprising:  
 providing a first catalyst for optimizing the storage of NO<sub>x</sub> emissions under lean air/fuel ratios, comprising a Perovskite-type  $\text{ABO}_3$  crystal structure wherein  
 the A cation sites are occupied by lanthanide ions and the B cation sites are occupied by cobalt ions, wherein from about 1 to up to 70% of the lanthanide A cation sites are substituted with a NO<sub>x</sub> trapping metal selected from the group consisting of barium, magnesium and potassium, wherein from about 1 to up to 60% of the cobalt B cation sites are substituted with a metal selected from the group consisting of platinum, rhodium, iron, copper and manganese; and  
 providing a second catalyst for optimizing the reduction of hydrocarbon, NO<sub>x</sub> and CO emissions under stoichiometric air/fuel ratios comprising a catalyst

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